



Mission Requirements

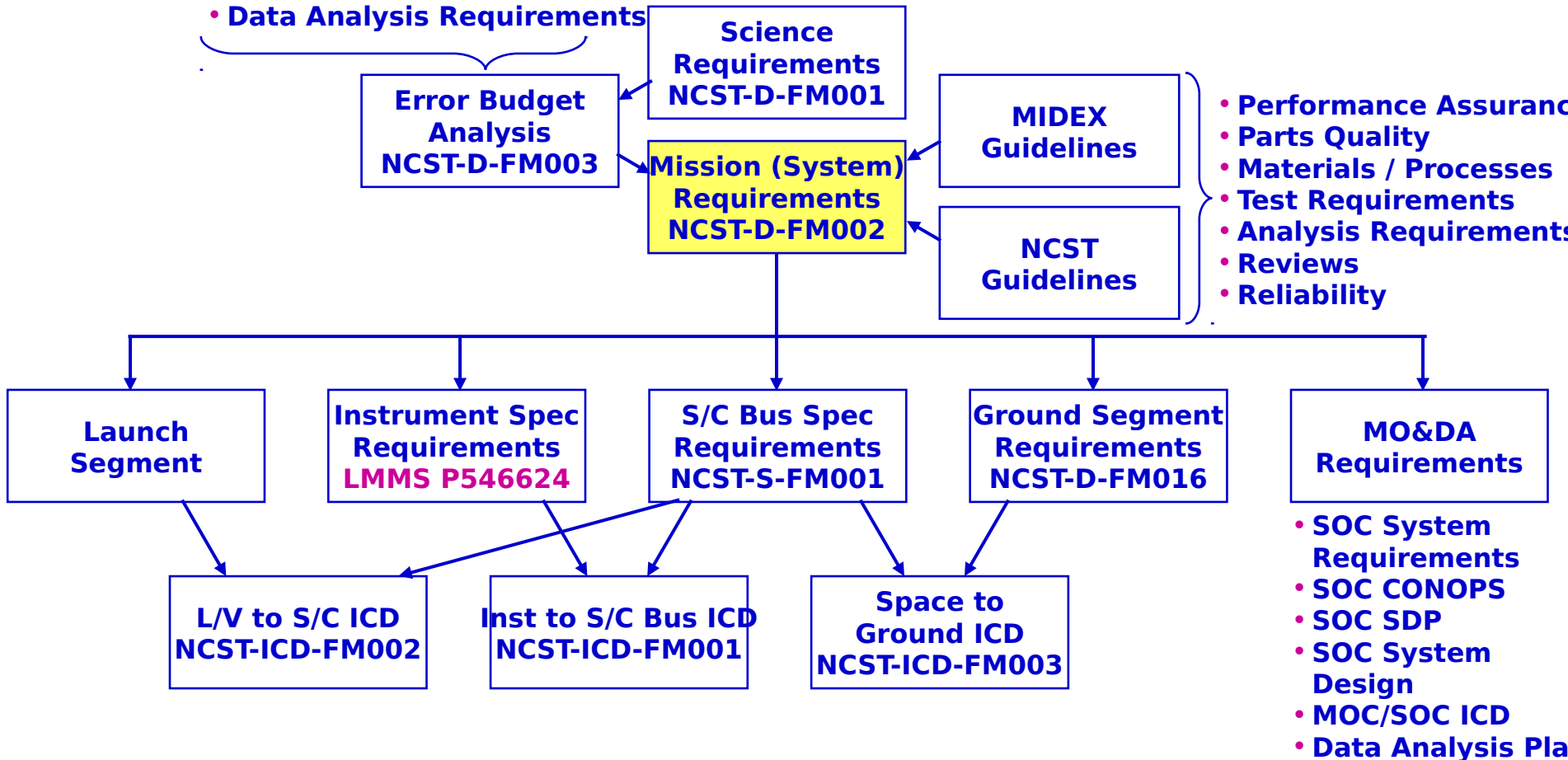
Mark Johnson
Program Manager
NRL
202-404-5328
johnson@ssdd.nrl.navy.mil



Requirements Flow



- Observation Requirements
- System Requirements
- Astrometric Requirements
 - Along Scan
 - Cross Scan
- Photometric Requirements
- Acquisition Requirements
- Data Analysis Requirements





Top-Level Mission Requirements



- **FAME Mission: Provide the Positions, Proper Motions, Parallaxes, and Photometry of Nearly All Stars as Faint as 15th Visual Magnitude With Accuracies of 50 μ as or 70 μ as/yr at 9th Visual Magnitude and 500 μ as or 500 μ as/yr at 15th Visual Magnitude**
- **Mission Requirements Documented in NCST-D-FM002**
- **Instrument Subset:**
 - **Instrument With Two Fields of View; Separated by 84 Degrees**
 - **Basic Angle Between Fields of View Stable to 10 μ as/10 Minutes**
 - **Observe Stars From 5th to 15th Magnitude**
 - **Focal Length of 10.5 Meters**
- **S/C Bus Subset:**
 - **Provide a Long-term, Stable Platform for the Payload**
 - **Spin Period: 40 \pm 4 Minutes During Data Collection**
 - **Sun Angle: 35 \pm 5 Degrees During Data Collection**
 - **Precession Period: 20 \pm 2 Days During Data Collection**



Flight Assurance Requirements (1 of 9)



- **Quality System (MRD Section 3.2.3)**
 - **Quality Assurance Plan (QAP) Based On Guidelines of ANSI/ASQC Q9001-1994**
 - **Includes Workmanship, Personnel Training, Non-Conformance Control, Procurement Control, Metrology, Configuration Management, Contamination Control, and QA Records**
 - **Documented in FAME Product Assurance Plan NCST-D-FM005**
- **Workmanship (MRD Sections 3.3.1.6, 3.3.5)**
 - **Employ Guidelines of NASA, Commercial and/or Military Standards**
 - **Soldering: ANSI/J-STD-001**
 - **Cable, Harness, and Wiring: NHB 5300.4 (3G)**
 - **Crimping: NHB 5300.4 (3H)**
 - **Conformal Coating and Staking: NHB 5300 (3J)**
 - **Printed Wiring Board Design: IPC-D-275**
 - **ESD Control: EIA-625**
 - **Printed Wiring Board Coupons Tested by GSFC Prior to Assembly of Circuit Cards (MRD Section 3.3.5)**



Flight Assurance Requirements (2 of 9)



- **Failure Reporting (MRD Section 3.3.1.6.3)**
 - **Failure Reporting, Analysis and Control Beginning at Acceptance Testing (per NCST-D-FM005)**
 - **Includes Discrepancy Reports for Hardware and Software**
 - **Failure Review Board (FRB) Chaired by the FAME Program Manager**
- **Reviews**
 - **System Requirements Review (SRR)**
 - **Preliminary Design Review (PDR) (End of Phase B)**
 - **Confirmation Review (CONR) (End of Phase B)**
 - **Briefing to NASA**
 - **Critical Design Review (CDR) (End of Phase C)**
 - **Pre-Environmental Review (PER) (Phase D)**
 - **Also Called Test Readiness Review (TRR)**
 - **Pre-Ship Review (PSR) (Phase D)**
 - **Flight Readiness Review (FRR) (Phase D)**



Flight Assurance Requirements (3 of 9)



- **System Safety Program (NCST-D-FM010)**
 - **Identify and Control Hazards to Personnel, Facilities, Support Equipment, and Flight System During All Stages of Development**
 - **Meet Requirements of EWRR 127-1 (Tailored per NCST-D-FM010)**
 - **Procedures (IAW NCST-D-FM023)**
 - **Develop and Submit Ground Operations Procedures**
 - **Identify and Highlight Hazardous Procedures**
 - **Comply With Applicable Launch Site Safety Regulations**
 - **Safety Data Package**
 - **Submit at Each Phase C/D Review, Up to and Including PSR**
 - **Include Detailed Description of Payload Design, Hazard Analysis Method, and Other Applicable Safety Related Information**
 - **Include Hazardous/Toxic Materials and Associated MSDS**
 - **Launch Site Safety Plan - As Required by Launch Site**



Flight Assurance Requirements (4 of 9)



- **Design Assurance**

- **Parts (MRD Section 3.3.1.1)**

- **EEE Parts Selected, Specified, Screened, and Qualified per GSFC 311-INST-001 Rev A, Quality Level 2 or Better**
 - **Develop and Maintain EEE Parts Identification List**
 - **NSPARs for Non-Standard Parts**

- **Materials and Processes (MRD Sections 3.3.1.5, 3.3.1.6)**

- **Implement Materials and Processes Program at Beginning of Phase B**
 - **Proposed Materials and Processes Documented and Available at PDR**
 - **Maintain List of Items and Appropriate Usage Records**
 - **TML <1% and CVCM <0.1%**
 - **MRD Identifies Requirements for Structural, Metallic, Magnetic, Finishes, and Stress Corrosion**



Flight Assurance Requirements (5 of 9)



- **Electromagnetic Environmental Requirements (MRD Section 3.3.2)**
 - **Defined in NCST-D-FM018, FAME EMI/EMC Control Plan**
 - **Includes Requirements for Bonding/Grounding**
 - **EMI/EMC Requirements Driven By:**
 - **Spacecraft Receiver Interference**
 - **Instrument Sensitivities**
 - **Range Requirements**



Flight Assurance Requirements (6 of 9)



- **Reliability Analysis**

- **Worst Case Analysis of All New Circuit Designs (MRD 3.2.3.6)**
- **FMEA for All Critical Interfaces (MRD 3.2.3.1)**
- **Fault Tree Analysis**
- **Probabilistic Risk Assessment**
- **Reliability Predictions (MRD 3.2.3.3)**
 - **No Minimum Reliability Number Specified**
 - **System Designed to Operate for 5 Years in FAME Orbit**
 - **Minimize Single Point Failures Within Cost and Schedule Constraints**



Flight Assurance Requirements (7 of 9)



- **Software**

- **Code Produced Shall Be Structured, Verified to Minimize Errors, and Maintainable**
- **All Software Under CM at Initial Capability Build**
- **S/W Development Plan (NCST-SDP-FM001)**
- **S/W Requirements Specification (NCST-SRS-FM001)**
 - **Includes the CSCI Requirements, I/O Interfaces, Design Description, and Source Code**
- **S/W Test Description Document (STD)**
 - **Includes Test Methodology for the CSCI and Any External Equipment/Simulations Necessary for Testing**
- **NASA Providing Software IV&V support**



Flight Assurance Requirements (8 of 9)



- **Verification Program**
 - **Ensure That the Spacecraft and Instrument Meet Specified Mission Requirements**
 - **Provide Verification Documentation, Including:**
 - **Verification Matrix As Part of Requirements Documents**
 - **Environmental Test Matrix**
 - **Verification Procedures**
 - **Test Procedures**



Flight Assurance Requirements (9 of 9)



- **Contamination, Control, and Cleanliness (MRD Section 3.3.10.3)**
 - **Defined in NCST-D-FM007, FAME Contamination Control Plan**
 - **Covers Fabrication, Integration, Testing, Storage, Handling, Transportation, and Launch Processing Requirements**



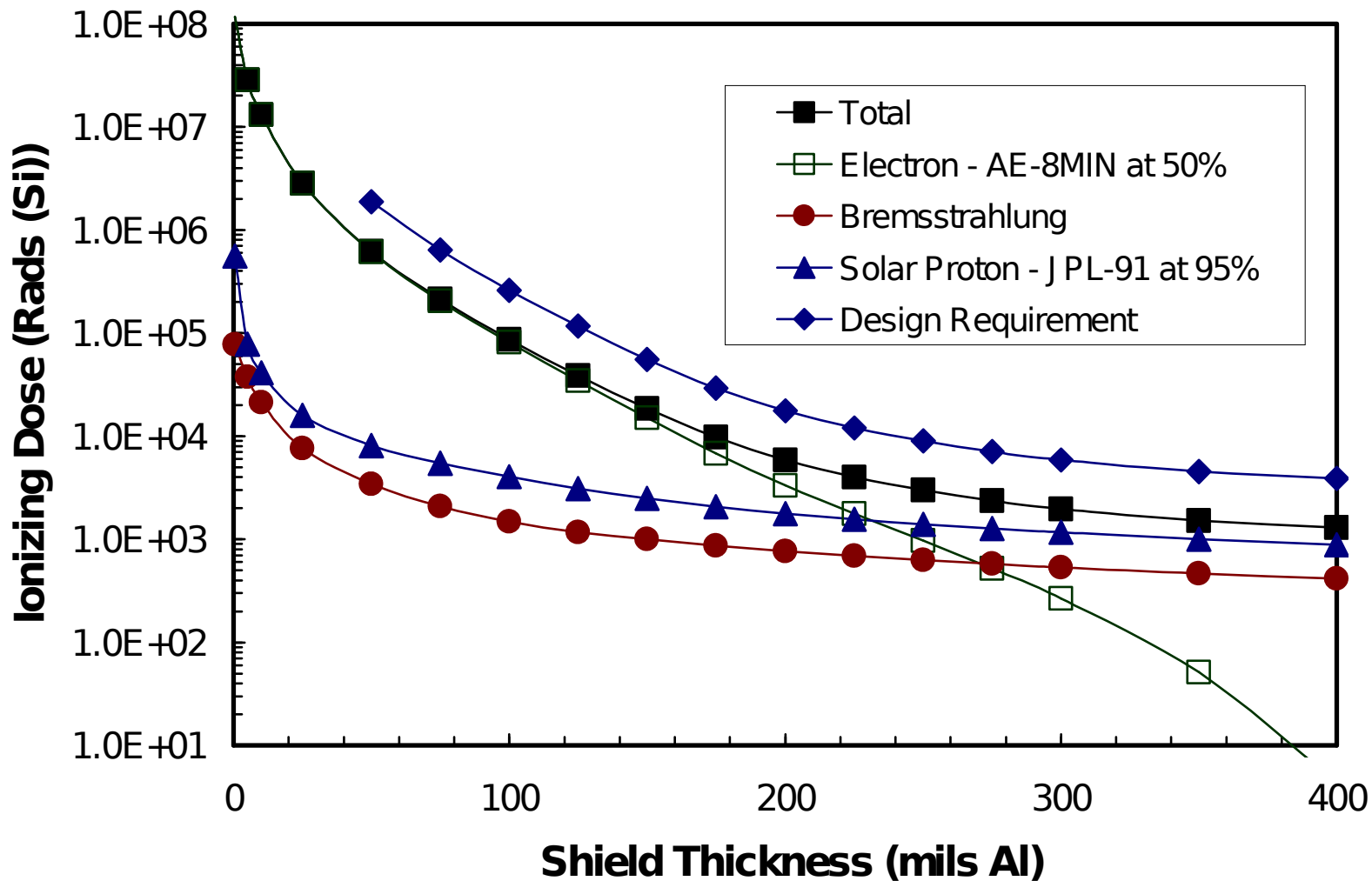
Radiation Requirements (1 of 2)



- **Particle Radiation (MRD Section 3.2.5.2.2.3)**
 - **Sources Include Galactic Cosmic Radiation, Geo-Magnetically Trapped Particle Radiation, and Solar Particle Event Radiation**
 - **Dose/Depth Curve Captures Requirements (Table 3-4/Figure 3-5)**
 - **Requirements for Total Dose and Single Event Effects (Single Event Induced Destructive, Non-Destructive, and Soft Errors)**



Dose Versus Depth for 2- π Shield





Launch Vehicle Requirements



- **Launch Vehicle Is a Delta 7425-10**
 - **Flight Environments Are Captured in NCST-D-FM017, FAME Design Loads and Analysis Plan**
 - **Includes Acoustics, Shock, Thermal, Limit Loads and Sine Vibration**
 - **Flight Vehicle Interfaces Are Captured in the S/C to Launch Vehicle Interface Requirements Document NCST-ICD-FM002**